ICM-EBB-XXX

Enhanced Baby Bear Programmable Logic Controllers

PLC on a Chip Patent 7,299,099

DATASHEET

Technical Datasheet Enhanced Baby Bear (ICM-EBB-XXX) Series Programmable Controllers

Models:

ICM-EBB-100
ICM-EBB-200
ICM-EBB-300
ICM-EBB-400
ICM-EBB-500
ICM-EBB-600
ICM-EBB-700

Revision 7
Release Date 1/31/2007

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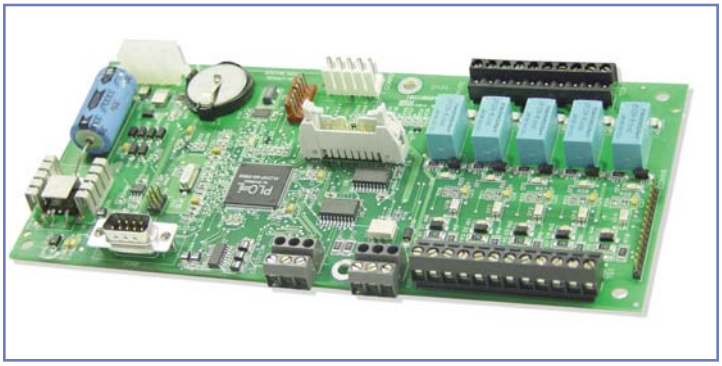
WARNING!

The ICM-EBB-XXX, as with programmable controllers, must not be used alone in applications which would be hazardous to personnel in the event of failure of this device. Precautions must be taken by the user to provide mechanical and/or electrical safeguards external to this device. This device is NOT APPROVED for domestic or human medical use.

Divelbiss Corporation ● 9778 Mt. Gilead Rd. ● Fredericktown, Ohio 43019 ● 1-800-245-2327 ● www.divelbiss.com



The Enhanced Baby Bear Series of programmable logic controllers builds on the rugged reliability and features of the Baby Bear Bones and adds even more versatility and features.

Designed with ***PLC on a Chip***, the EBB-XXX is easy to use and program using EZ LADDER®, providing complete control over unlimited control applications.

The EBB-XXX programs in Ladder Diagram with additional function blocks. The ICM-EBB-XXX has identical dimensions and mounting as the original Baby Bear Bones

Features

Model	Flash Memory	On-board I/O	I/O Expansion Type	CAN Port	Real Time Clock	Counter Input	Comport 1	Comport 2	Board Power
EBB-100	128 K	5 Inputs 10-32VDC / 10-30VAC RMS 5 Relay Outputs	None	No	No	No	Programming Port, RS232	None	12 VDC or *10VAC
EBB-200	128 K	5 Inputs 10-32VDC / 10-30VAC RMS 5 Relay Outputs	None	No	No	Yes	Programming Port, RS232	None	12 VDC or *10VAC
EBB-300	128 K	5 Inputs 10-32VDC / 10-30VAC RMS 5 Relay Outputs	None	No	Yes	Yes	Programming Port, RS232	None	12 VDC or *10VAC
EBB-400	128 K	5 Inputs 10-32VDC / 10-30VAC RMS 5 Relay Outputs	Baby Bear I/O Expander (8 DC Inputs 8 Relay Outputs)	No	Yes	Yes	Programming Port, RS232	None	12 VDC or *10VAC
EBB-500	128 K	5 Inputs 10-32VDC / 10-30VAC RMS 5 Relay Outputs	High Density I/O Expanders (120 Inputs 120 Outputs)	No	Yes	Yes	Programming Port, RS232	None	12 VDC or *10VAC
EBB-600	256 K	5 Inputs 10-32VDC / 10-30VAC RMS 5 Relay Outputs	Baby Bear I/O Expander (8 DC Inputs 8 Relay Outputs)	Yes	Yes	Yes	Programming Port, RS232	**RS 232, **RS422, or **RS 485	12 VDC or *10VAC
EBB-700	256 K	5 Inputs 10-32VDC / 10-30VAC RMS 5 Relay Outputs	High Density I/O Expanders (120 Inputs 120 Outputs)	Yes	Yes	Yes	Programming Port, RS232	**RS 232, **RS422, or **RS 485	12 VDC or *10VAC

* with optionally purchased transformer.
** with optionally purchased serial port module. Specify RS232, RS422 or RS485.

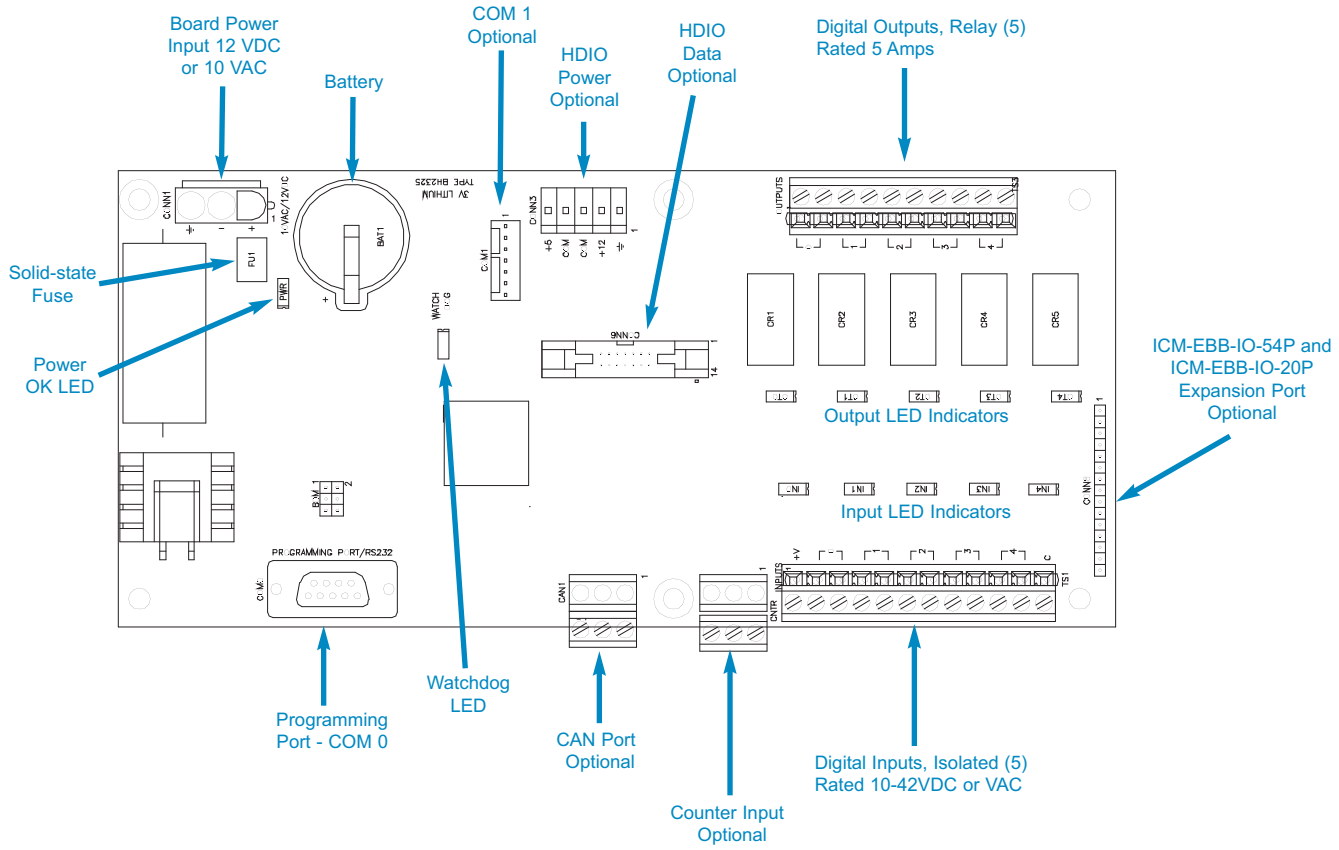
Programming

The ICM-EBB-XXX Series PLCs program in Ladder Diagram using Divelbiss' EZ LADDER®, a Ladder Diagram Development Platform. Divelbiss' EZ LADDER® parallels the IEC-61131 standard and provide an easy to use interface.

After a ladder diagram program is developed, it is downloaded to the Enhanced Baby Bear using a serial port. Once the download is complete, the EBB is successfully programmed and begins executing the program. The program is stored on non-volatile FLASH memory and is automatically executed on power up.

Refer to the EZ LADDER User's Manual for more detail on creating ladder diagram programs, connecting to targets and downloading the program to targets.

Connections

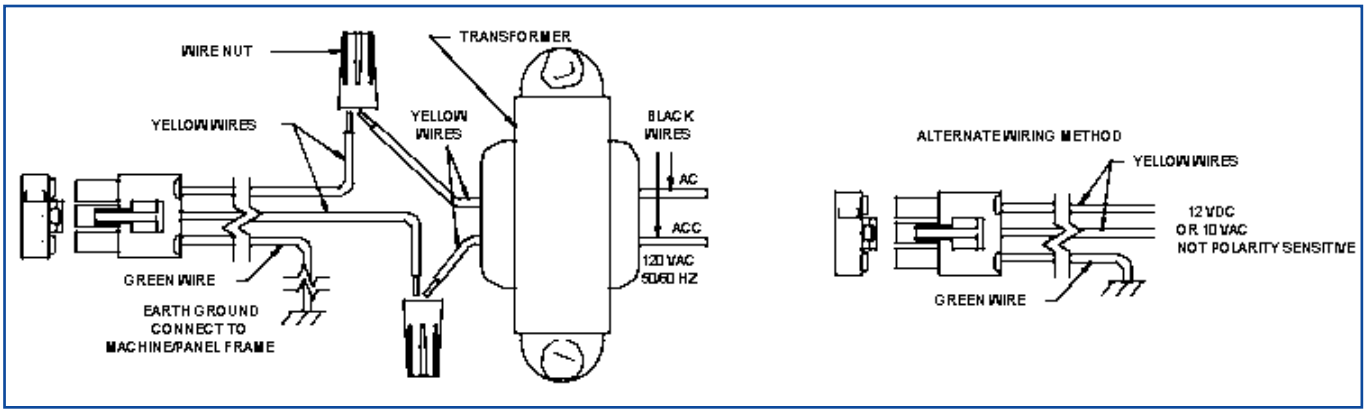


Input Power

The ICM-EBB -XXX may be powered using 10 VAC or 12 VDC. Apply power to CONN1 using the provided input power cable assembly (PIMS-CA-6). Refer to the input power schematic for details. The transformer shown is optional.

Divelbiss recommends a step down transformer, 110 VAC to 10 VAC, @ 2A. The transformer may be purchased from Divelbiss Corporation (115VAC Primary: 109-101153, 230VAC Primary: 109-100924)

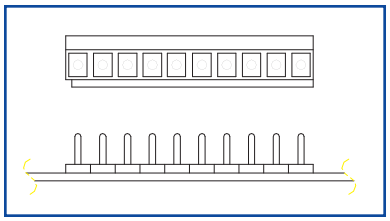
The ICM-EBB-XXX is protected by a “resettable” fuse. If the fuse should open (the power LED is not illuminated), remove the input power for 30 seconds and then reconnect the input power. The fuse will automatically reset when the power is removed.



Input Power Schematic

Digital Input / Output Terminal Strips

The input and output terminal strips are “unplugged” and “plugged in” vertically on to connection pins that are located on the EBB-XXX controller board.



Terminal Strip Removal / Insertion

Digital Inputs

Each EBB Series PLC comes standard with five (5) digital inputs, rated 10-42VDC or 10-30VAC RMS. All digital inputs are optically isolated to provide immunity from noise and interference.

The EBB-XXX inputs are not polarity sensitive.

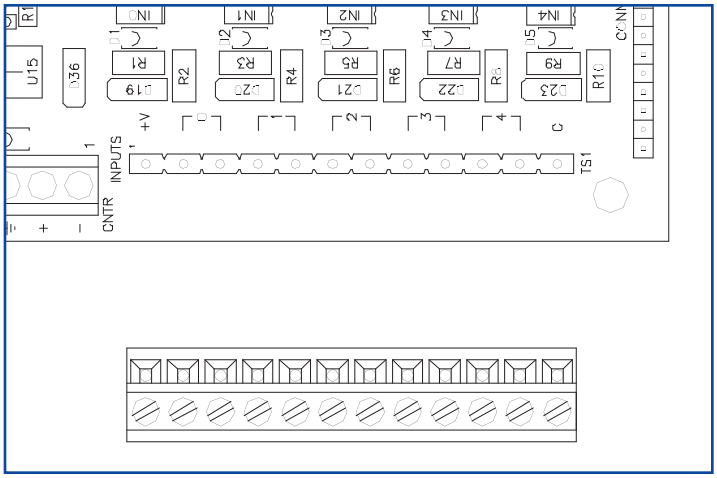
EZ LADDER input assignments for the EBB-XXX are DI1.03 (Input 0) to DI1.07 (Input 4).

Inputs connections are labeled:

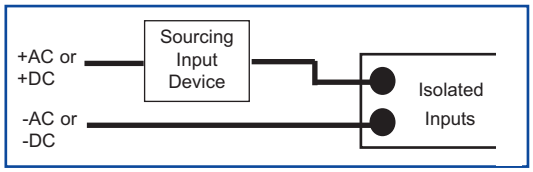
0 - 4 Digital Input Terminals.

+V Unregulated supply (approximately 12 VDC). This may be used to power sensors and other devices.

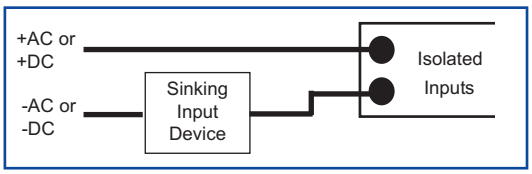
C Common return for the +V supply.



Typical Input Wiring Diagrams



Typical Sinking Input Circuit



Typical Sourcing Input Circuit

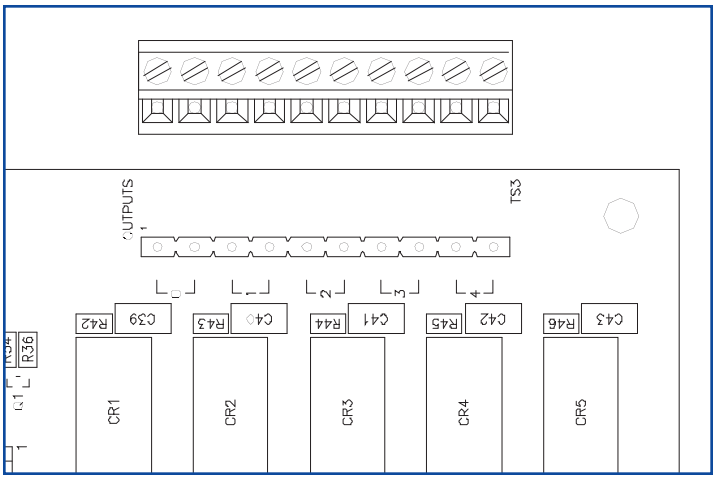
Digital Outputs

Each EBB Series PLC comes standard with five (5) relay outputs, rated 5 Amps.

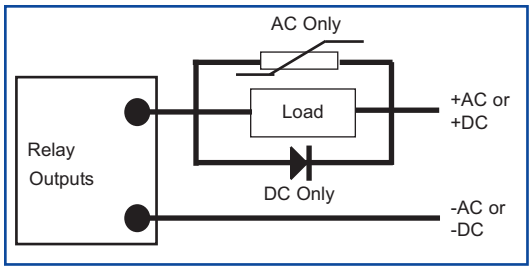
EZ LADDER output assignments for the EBB-XXX are DO1.03 (Output 0) to DO1.07 (Output 4).

Outputs connections are labeled:

0 - 4 Relay output contact pins.



Typical Output Wiring Diagrams

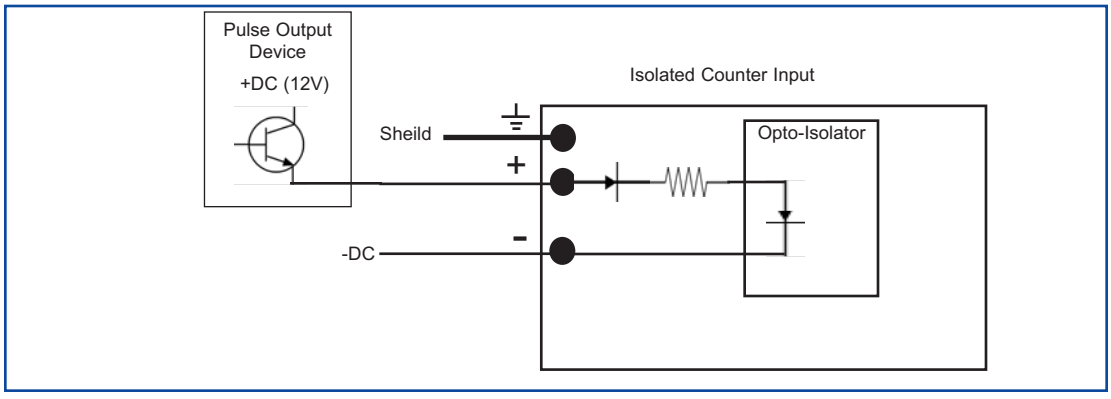


Typical Output Circuit Connection

Counter Input

The ICM-EBB-XXX provides an optional on-board counter input (model dependent). This is an up counter input with capabilites to 100 KHz. It is ideal for connecting flowmeters and other pulse output devices and sensors.

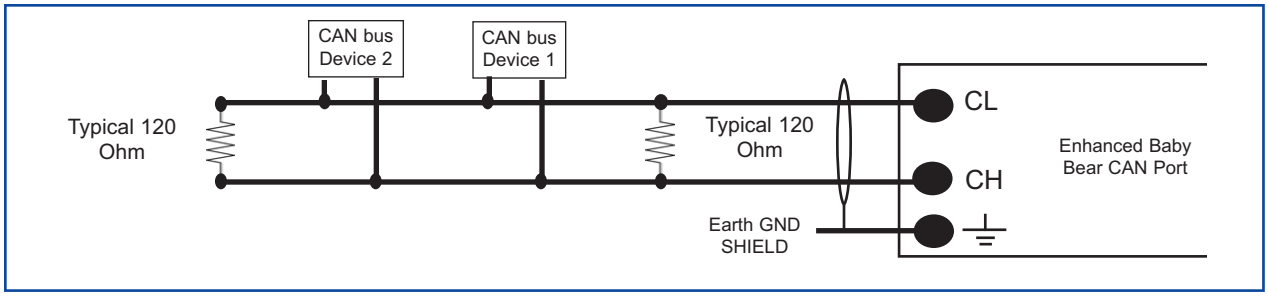
Connect the CNTR input as shown. The counter is optically isolated to provide immunity from noise and interference.



Typical Counter Input Circuit

CAN Interface Port

The EBB-XXX provides an optional on-board CAN bus interface port. This port supports the Divelbiss OptiCan and J1939 Communications.



Typical CAN bus Circuit

Input / Output Expansion

In addition to the 5 input and 5 outputs, the EBB-XXX has the ability to expand its I/O (model dependent). The I/O may be added using two types of additional inputs and outputs.

Baby Bear I/O Expanders

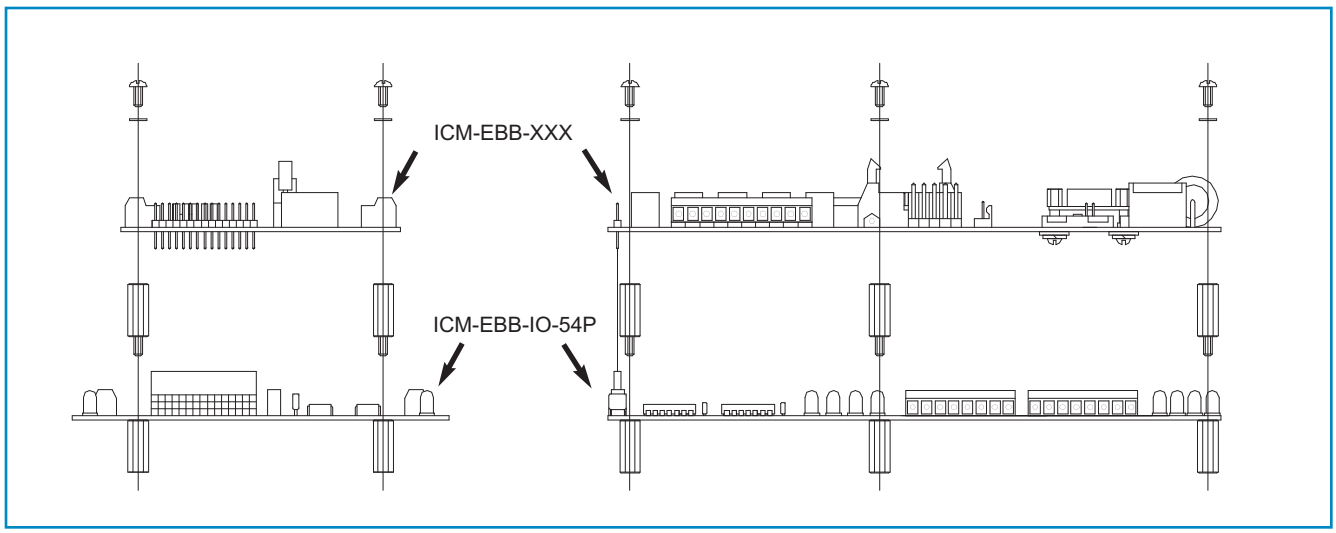
The ICM-EBB-XXX's I/O can be expanded with an additional 8 Inputs (10-32 VDC) and 8 Relay Outputs using the ICM-EBB-IO-54RE-P.

Baby Bear Expanders use the EBB-XXX's CONN8. The ICM-EBB-IO-54P connects directly to CONN8 and is mounted to the EBB-XXX (stackable configuration).

The I/O addressing for the ICM-EBB-IO-54P is always as follows:

Digital Inputs: DI1.08 - DI1.15

Digital Outputs: DO1.08 - DO1.15



ICM-EBB-IO-54RE-P Stackable Mounting

PIC-IO-54P vs ICM-EBB-IO-54RE-P

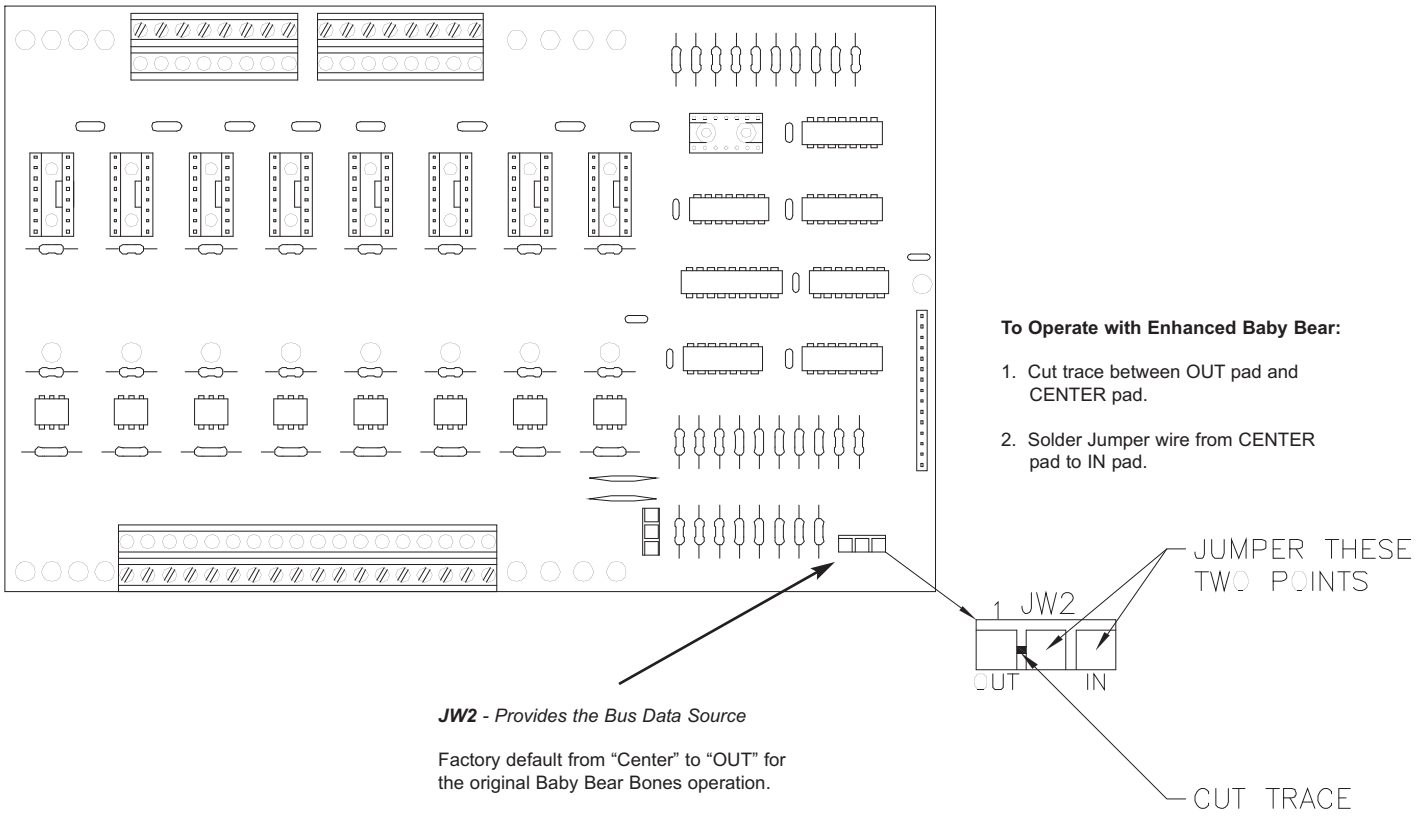
The ICM-EBB-IO-54RE-P is factory configured to operate only with the Enhanced Baby Bear (ICM-EBB-XXX). The PIC-IO-54P is factory configured to operate only with the original Baby Bear Bones (ICM-BB-12P, ICM-BB-13P, ICM-BB-21P, ICM-BB-22P). Note: The ICM-EBB-IO-54RE-P now includes factory installed relays.

Should you need to use a PIC-IO-54P with the Enhanced Baby Bear, jumpers will need to be reconfigured on the PIC-IO-54P board prior to installation.

To make the jumper changes, the following is required.

1. Soldering Iron
2. 0 Ohm Jumper or Wire Jumper
3. “X-Acto” knife or equivalent.

With the above equipment, follow the diagram below for modifiying the PIC-IO-54P to operate with the Enhanced Baby Bear.



High Density I/O Expanders

The EBB-XXX's I/O can be expanded with up to an additional 120 Inputs and 120 Outputs using the ICM-HDIO-XX series I/O Expander boards. The ICM-HDIO-XX series provides a wide range of input and output types and voltages.

High Density I/O Expanders use the EBB-XXX's CONN6 (for data) and CONN3 (for power). These connections are made via cables. The ICM-HDIO-XX boards are din rail mounted and have addressible addresses.

The I/O addressing for the ICM-HDIO-XX are as follows:

Digital Inputs: DI0.00 - DI0.15
DI1.00 - DI1.07 are used on board the ICM-EBB-XX and are NOT valid.
DI1.08 - DI7.15

Digital Outputs: DO0.00 - DO0.15
DO1.00 - DO1.07 are used on board the ICM-EBB-XX and are NOT valid.
DO1.08 - DO7.15

COM 0 (Programming Port)

The EBB-XXX is programmed via COM 0. This RS232 serial port is only to be used for programming using Divelbiss' EZ LADDER. This is not a general purpose port. A null modem cable should be used to connect with COM 0. This cable may be purchased from Divelbiss (use Part Number: ICM-CA-34).

RS232 Serial Port Module

Pin	ID	Description
1	--	No Connect
2	RX	Receive Data
3	TX	Transmit Data
4	--	No Connect
5	GND	Signal Ground
6	--	No Connect
7	RTS	Request To Send
8	CTS	Clear To Send
9	--	No Connect

COM 0 - Serial Port Pin-Out

COM 1 (Optional)

The ICM-EBB-XXX (256K Models) have the option of an additional serial port. This port may be ordered as an RS232, RS422 or an RS485 interface. This port supports Modbus Slave.

This serial port is a plug-in module that connects to the ICM-EBB-XXX COM1 connector. The optional serial port module mounts to the EBB-XXX vertically using provided hardware. See the Serial Port Module Mounting diagram and Serial Port Pin-Outs for more detail.

Serial Port Module Part Numbers:

RS232 Module	ICM-EBB-RS232
RS422 Module	ICM-EBB-RS422
RS485 Module	ICM-EBB-RS485

RS232 Serial Port Module

Pin	ID	Description
1	--	No Connect
2	RX	Receive Data
3	TX	Transmit Data
4	--	No Connect
5	GND	Signal Ground
6	--	No Connect
7	RTS	Request To Send
8	--	No Connect
9	--	No Connect

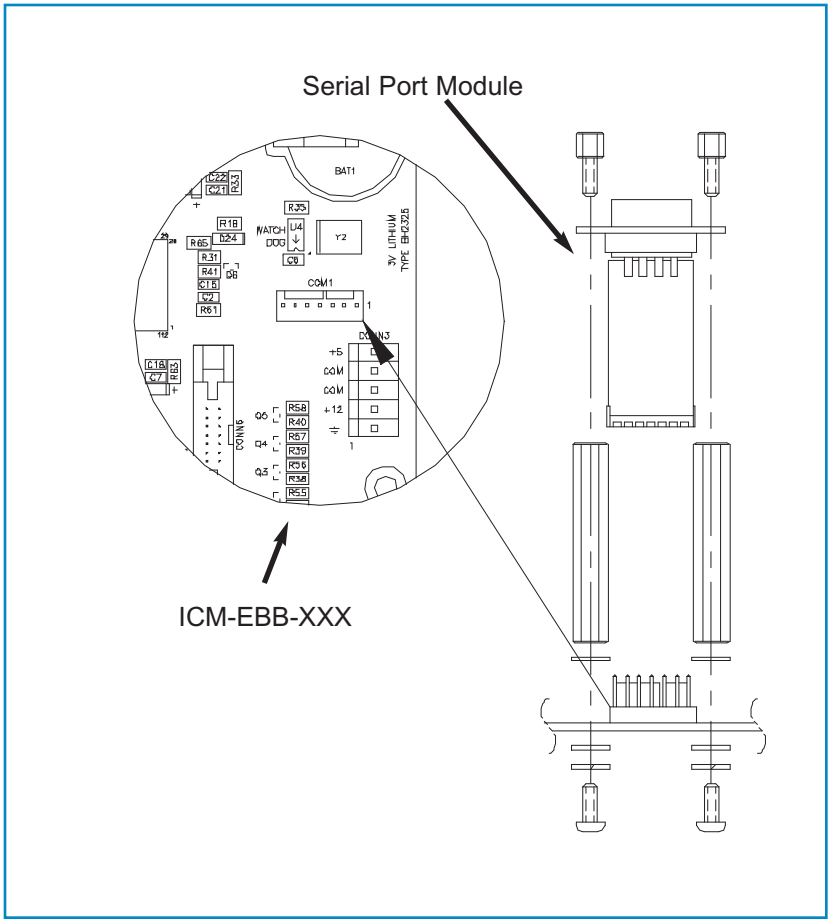
RS422 Serial Port Module

Pin	ID	Description
1	TX-	Transmit Data (-)
2	--	No Connect
3	--	No Connect
4	RX-	Receive Data (-)
5	GND	Signal Ground
6	RX+	Receive Data (+)
7	--	No Connect
8	--	No Connect
9	TX+	Transmit Data (+)

RS485 Serial Port Module

Pin	ID	Description
1	TX-	Data (-)
2	--	No Connect
3	--	No Connect
4	--	No Connect
5	GND	Signal Ground
6	--	No Connect
7	--	No Connect
8	--	No Connect
9	TX+	Data (+)

COM 1 - Serial Port Module Pin-Outs



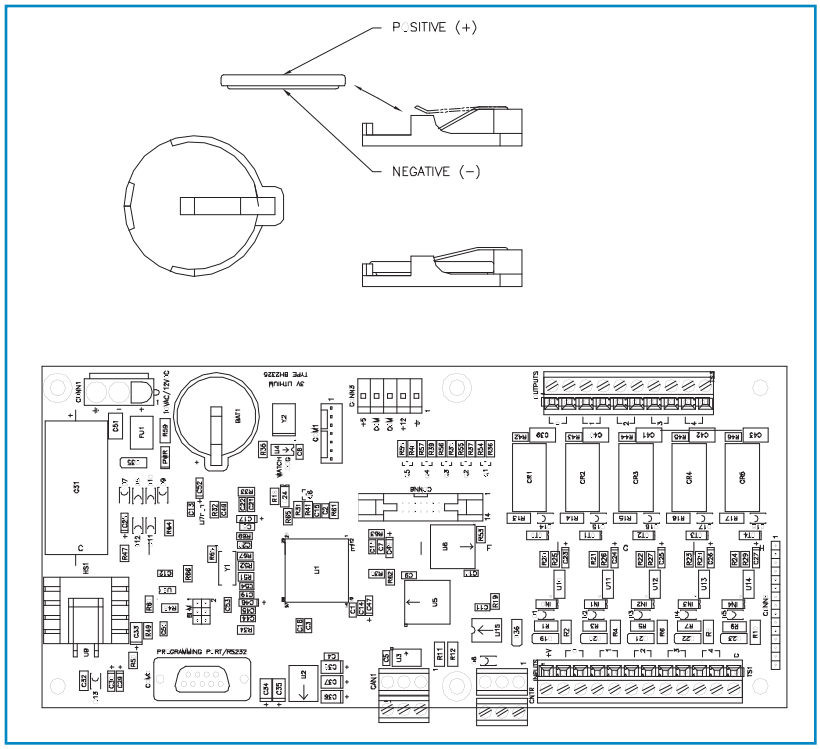
Serial Port Module Mounting

Real Time Clock

The EBB-XXX includes an optional Real Time Clock. The real time clock (after set) provides Month, Day, Day of the Week, Year, Hour, Minute and Second. The real time clock maintains time when power is lost via lithium battery.

The life of the battery for the real time clock generally has years of life before replacement is needed. Should the battery need to be replaced, replace the battery with the same type and size as the original. See the Battery Replacement diagram.

The battery is a Lithium Coin Cell, Type BR2325.



Battery Replacement Diagram

Specifications

Input Power	12 VDC or 10 VAC, 115 VAC with Optional Transformer
Operating Temperature	0 - 60 degrees C
Programming Language	Ladder Diagram
Digital Inputs	5
Type	Optically Isolated, Solid State
Polarity Sensitive	No
Input Voltage	10-32 VDC / 10-30 VAC RMS
LED Indicators	Yes
Turn On Level	Typical 4.5VAC/VDC
Turn Off Level	Typical 3.5VAC/VDC
Input Current	Typical 9mA @ 30 VDC / VAC
Digital Outputs	5
Type	Relay, Normally Open Contact
Output Voltage	1/8 HP, 125 VAC / 250 VAC, 5A @ 30VDC / 250 VAC Resistive
Output LED Indicators	Yes
I/O Expansion(Optional)	Yes, Baby Bear I/O Expansion or High Density I/O Expansion
Expansion Inputs	8 - Baby Bear Expansion, 120 High Density I/O Expansion
Expansion Outputs	8 - Baby Bear Expansion, 120 High Density I/O Expansion
Input / Output Expansion Voltage	Varies per Model.
Counter Input(Optional)	Yes
Type	Up Count Pulse Input, Optically Isolated
Maximum Frequency	100 KHz
COM 0	Programming Port, RS232
Maximum Baud Rate	57600 bps
COM 1 (Optional 256K Models Only)	General Purpose Port, RS232 or RS422 or RS485
Maximum Baud Rate	57600 bps
Modbus	Slave
CAN1 (Optional)	1 CAN Port
Networks Supported	Divelbiss OptiCan, J1939
Output Power (to I/O)	
+5VDC	5VDC +/- 5%, 360mADC Max.
+V	12VDC +/- 15%, 600mADC Max.
Battery	BR2325 Lithium Coin Type
Voltage	3VDC
Mounting	Stand-off Hardware
Connections	Quick Disconnect Terminal Strips and Connectors Standard
Memory	128K FLASH - 256K FLASH, Model Dependent
Real Time Clock (Optional)	Month, Day, Day of Week, Year, Hour, Minute and Second
Dimensions	8.75” Wide x 4” Tall x 1” Depth (not including optional serial modules)

EZ LADDER Information

Supported EZ LADDER Functions

The ICM-EBB-XXX Series of programmable controllers are programmed using the Divelbiss EZ LADDER ladder diagram development platform. Below is the list of features provided in EZ LADDER that are available to use with any PLC on a Chip model. Refer to the EZ LADDER User's manual for detail on each function.

ABS
ADD
AND
AVG
BIT PACK
BIT UNPACK
BOOLEAN
CMP
CNTRTMR
DIRECT COIL
DIRECT CONTACT
DIV
DOWN COUNTER (CTD)
DRUM_SEQ
EEPROM_READ
EEPROM_WRITE
EQUAL TO (=)
FALLING EDGE DETECTOR (FTRIG)
GETDATE
GETTIME
GREATER THAN (>)
GREATER THAN OR EQUAL TO (>=)
HIGH_SPD_TMR
HYSTER
INTEGER
INVERTED COIL
INVERTED CONTACT
J1939 GET SPN
LATCH
LESS THAN (<)
LESS THAN OR EQUAL TO (<=)
LIMIT
MAVG
MAX
MIN
MOD
MULT
MUX
NOT
NOT EQUAL TO (<>)
OFF DELAY TIMER (TOFF)
ON DELAY TIMER (TON)
OR
PULSE TIMER (TP)
REAL
RISING EDGE DETECTOR (RTRIG)
ROL
ROR
RS
SEL
SERIAL_PRINT
SETDATE
SETTIME
SHL
SHR
SR
SUB
TIMER
UNLATCH
UP COUNTER (CTU)
UP / DOWN COUNTER (CTUD)
XOR

Scan Time

The Enhanced Baby Bear scan time is based on a 100 microsecond resolution. The HIGH_SPD_TMR function is based on the same resolution.

Target Project Settings

Before EZ LADDER can function with a the EBB-XXX, the target must be selected and options installed.

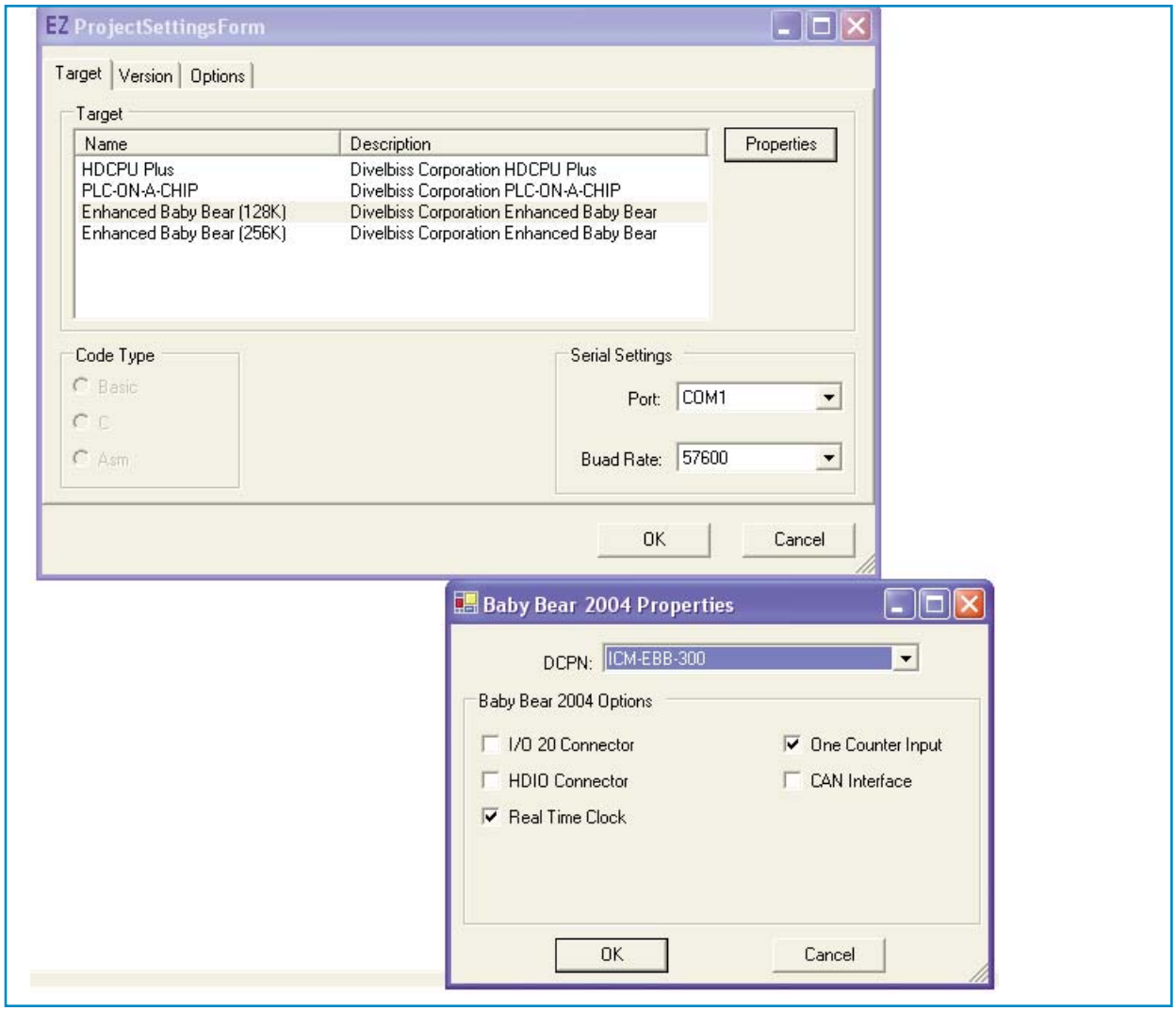
To configure the target settings, in EZ LADDER, click **PROJECT**, then click **SETTINGS** from the top menu bar. Select (highlight) the correct “Enhanced Baby Bear XXX” target; either 128K or 256K. To determine this setting, look up the memory size on page 3 (Models Chart) using the board part number.

Once the “Enhanced Baby Bear XXXK” target is selected, it must be configured with options that will be used in the ladder diagram program and hardware. Click the **PROPERTIES** button, which is only available when “Enhanced Baby Bear XXXK” is selected as the target. Another dialog box will appear with a drop down model button. Select the correct EBB-XXX model. The available options will be shown with checks in their select boxes.

Click **OK** for the properties.

Ensure the Baud rate is set for 57600 and the serial port number is correct. Click **OK** to exit the *Project Settings*.

Save this project to store the target configuration.



ICM-EBB-XXX Project Settings

Troubleshooting

Symptom	Cause / Action
+V / +5V is not present (No Power LED).	Unit not powered up (not plugged in) Power fuse open. Cycle power for 30 seconds.
Watchdog LED not blinking.	Unit not powered up (not plugged in) Power fuse open. Cycle power for 30 seconds. Board is malfunctioning. Contact Divelbiss for service.
Input / Outputs (and LEDs) not functioning.	No Program Loaded. Incorrect addressing assigned to I/O variables. See pages 5-6.
EZ LADDER cannot connect to COM 0.	Check Serial Port Settings and Baud Rate Use Null Modem Cable.
Real Time Clock does not keep correct time.	Battery is too low or dead to maintain time. Time was not initially set.

Accessories

Optional Add-Ons & Accessories

Serial Port Modules	
RS232	ICM-EBB-RS232
RS485	ICM-EBB-RS485
RS422	ICM-EBB-RS422
Transformers	
115V Pri / 10V Sec	109-101153
230V Pri / 10V Sec	109-100924
Baby Bear Expanders	
8 In / 8 Relay Out Stackable	ICM-EBB-IO-54RE-P
High Density I/O Expanders	
Various Models and Features	ICM-HDIO-XXP
Cables	
Null Modem Programming Cable	ICM-CA-34